Particle Swarm Optimization Methods for Pattern Recognition and Image Processing

by

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Abstract

Pattern recognition has as its objective to classify objects into different categories and classes. It is a fundamental component of artificial intelligence and computer vision. This thesis investigates the application of an efficient optimization method, known as Particle Swarm Optimization (PSO), to the field of pattern recognition and image processing. First a clustering method that is based on PSO is proposed. The application of the proposed clustering algorithm to the problem of unsupervised classification and segmentation of images is investigated. A new automatic image generation tool tailored specifically for the verification and comparison of various unsupervised image classification algorithms is then developed. A dynamic clustering algorithm which automatically determines the "optimum" number of clusters and simultaneously clusters the data set with minimal user interference is then developed. Finally, PSO-based approaches are proposed to tackle the color image quantization and spectral unmixing problems. In all the proposed approaches, the influence of PSO parameters on the performance of the proposed algorithms is evaluated.

Key terms: Clustering, Color Image Quantization, Dynamic Clustering, Image Processing, Image Segmentation, Optimization Methods, Particle Swarm Optimization, Pattern Recognition, Spectral Unmixing, Unsupervised Image Classification.

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"Obstacles are those frightening things you see when you take your eyes off your goal."

Henry Ford

"You will recognize your own path when you come upon it, because you will suddenly have all the energy and imagination you will ever need."

Jerry Gillies

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